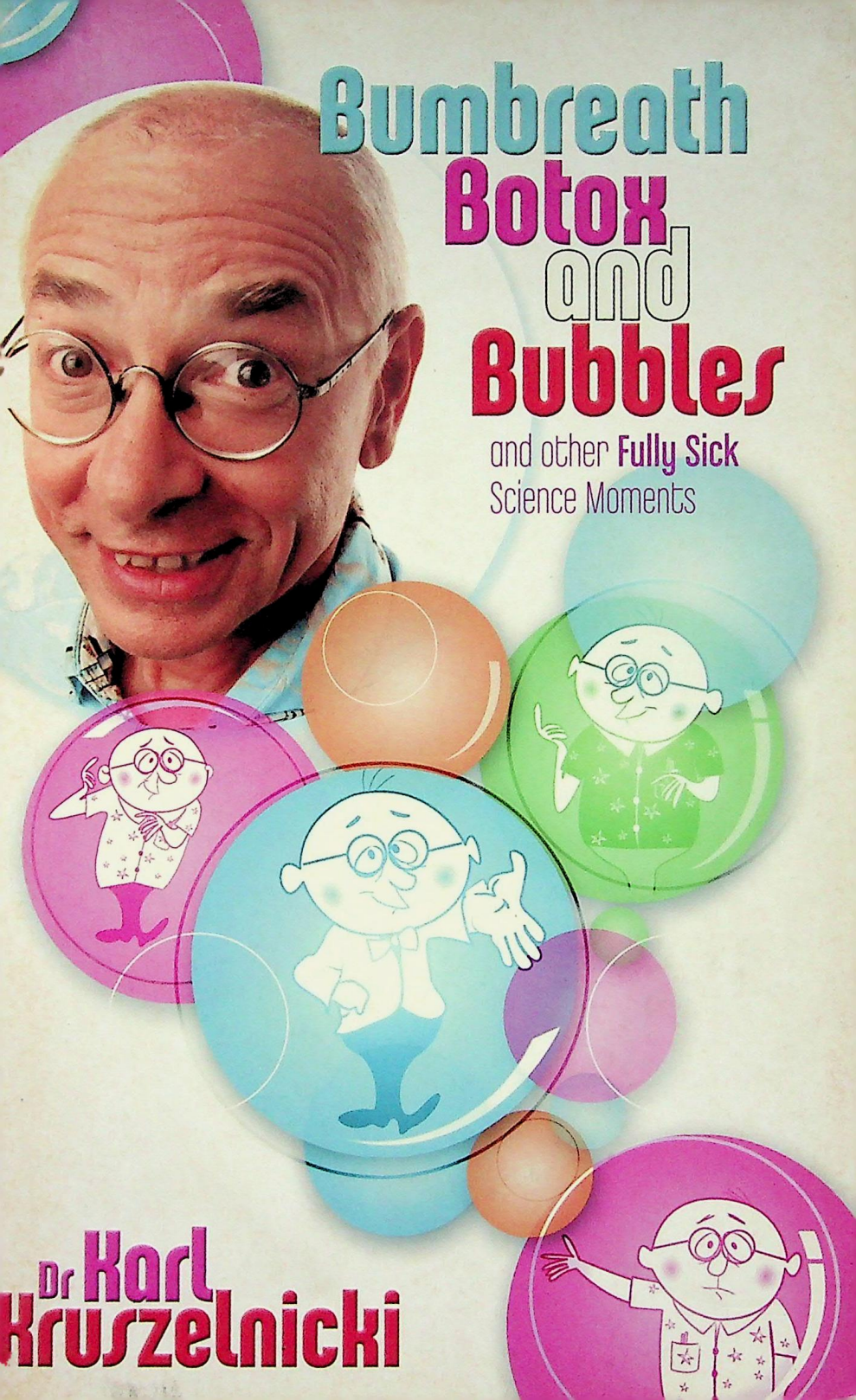
Bumbreath Botox and Bubbles

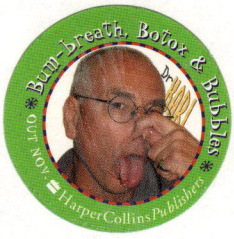
and other **Fully Sick** Science Moments

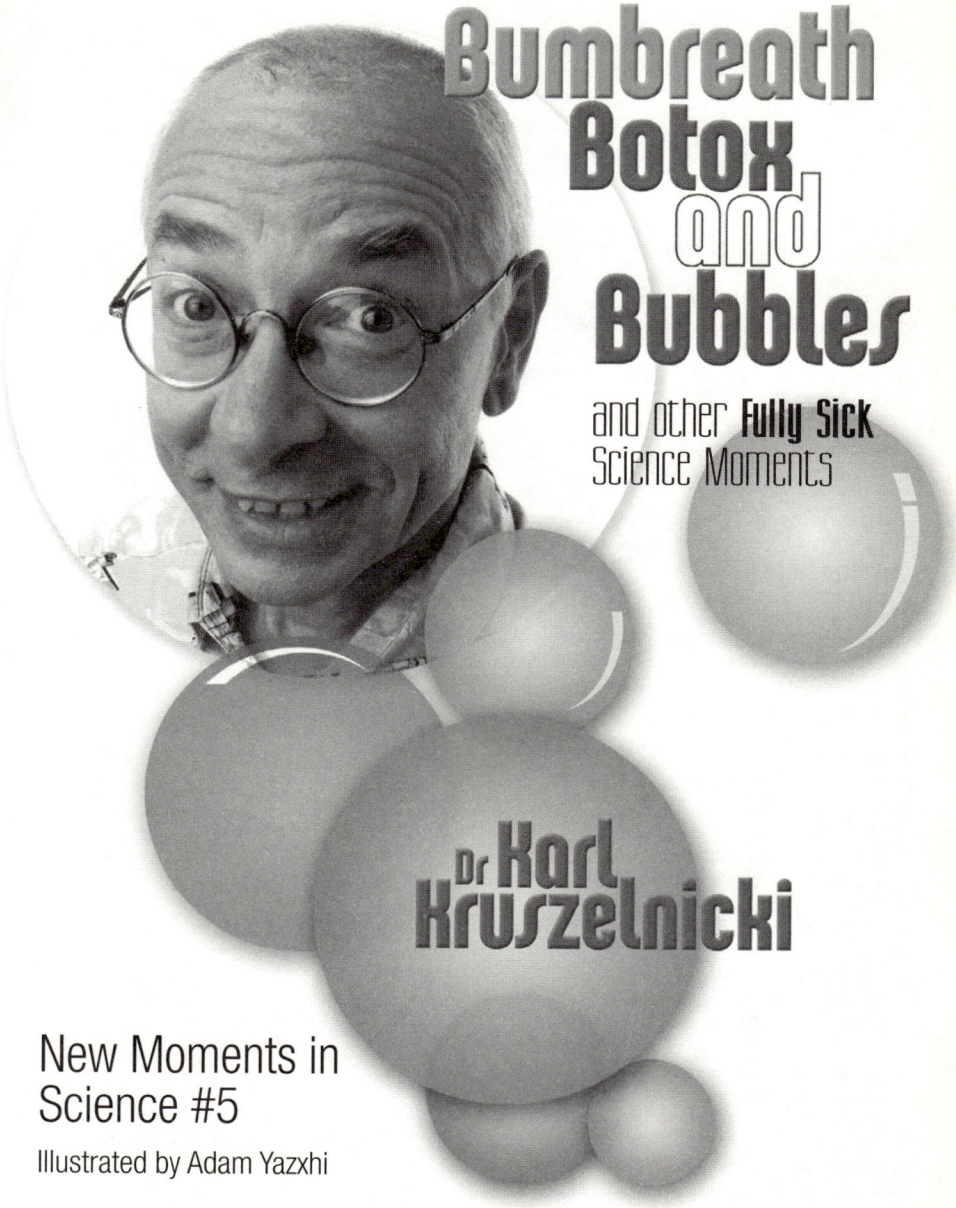


Dr Karl Kruszelnicki

Best Wishes
Dr Karl
13 Nov 2007

Bumbreath Botox and Bubbles





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for my family

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When she was about five years old, my little daughter Alice bounced into the bedroom one morning to give me a big hug and then immediately said, '*Hey Dad, you smell like a bum.*' She was right. Like most people, I suffered the dreaded 'Morning Breath'.

bumbreath

So I went looking in the medical and scientific literature, and found nothing. But in 1999, I was thrilled when I discovered that Dr Michael Levitt and his colleagues presented a preliminary report on my problem of Morning Breath at the Fourth International Conference on Breath Odor in Los Angeles. I found out how to fix my Morning Breath, and also discovered that bad breath comes from that moist bacterial jungle in your mouth.

Some of these mouth bacteria make truly nasty chemicals, some with disgusting names. There's 'putrescine' which gives decaying meat its special fragrance; 'cadaverine' which is usually given off by corpses; 'skatole' and 'methyl mercaptan' which smell like faeces; 'isovaleric acid' which smells like sweaty feet; and 'hydrogen sulphide' which smells like rotten eggs. The bacteria also emit 'indole', which smells lovely at low concentrations and is

used sparingly in perfumes, but strangely smells foul at high levels. It shows how little we know about 'smells', that we don't understand why indole behaves likes this.

the problem

Many people think they suffer from bad breath.

In the USA, half a million of these people turn up to dentists each week complaining about their bad breath. The polite medical word is 'halitosis' — Latin *halitus* means 'breath', and the Greek *-osis* means 'abnormal condition of'. In fact, about 20% of the US population think they have a long-term problem with halitosis. To fix this problem, in the year 2000, Americans spent US$1.8 billion on toothpaste, US$950 million on toothbrushes and dental floss, US$740 million on mouthwashes and other dental rinses, US$715 million on oral-care gum and US$625 million on breath fresheners (excluding mouthwash and gum).

'Halitophobe' is the name given to people who worry so much about their bad breath that it interferes with their normal life.

Back in the old days, people wrongly believed that rotten food in your gut gave off bad smells which came up via your oesophagus into your mouth, and finally into somebody's face. But thanks to the work of Breath Scientists like Professor Mel Rosenberg, we now know better.

Mel Rosenberg is Professor of Microbiology at the Department of Oral Biology in Dental Medicine at the Tel-Aviv University School of Dental Medicine. He says most bad breath occurs in the mouth, and hardly any comes from below the tonsils.

Mel Rosenberg says people who are most at risk of bad breath (once all the other causes have been excluded) are people who talk a lot.

mel's meteoric rise

Alice Shirrell Kaswell and Stephen Drew honoured Mel Rosenberg with their article in the *Annals of Improbable Research*. They write of his many university and hospital positions around the world. They also quote some of his research papers that *'tell the exciting story of how one man helped a tiny field of research blossom, grow, and finally attain recognition as a distinct branch of science.'*

It didn't come easy — he had to work hard to get to his present pinnacle of fame. He says: *'Over the past 15 years I have had the opportunity to smell the mouths of thousands of individuals in clinics and in research studies, not to mention the hundreds I have smelled surreptitiously in supermarkets, in airplanes, and in synagogue during the fast day of Yom Kippur.'*

In the early years he wrote *'Bad Breath: Diagnosis And Treatment'* (1990) which was then followed by *'Measurement of Oral Malodor: Current Methods and Future Prospects'* (1992). He achieved international recognition in 1994 with his paper *'Conference Report: The First International Workshop on Oral Malodor'*.

Mel then showed his potential for creating rapid technical progress in the field of bad breath with his 1995 paper *'Self-estimation of Oral Malodor'* followed by his 1996 paper, *'Developments in Diagnosis and Treatment of Bad Breath'*.

In his psychological years, he wrote *'Self-Perception Of Breath Odor: Role Of Body Image And Psychopathologic Traits'* (2000).

In 2001, Mel's chosen field blossomed. The growing International Society for Breath Odor Research (ISBOR) had some 350 delegates attending its fifth international meeting in Tokyo.

He finally achieved his deserved recognition for having helped create a mature, freestanding branch of science with his article in the *Scientific American* called *'The Science of Bad Breath'* (2002).

Good Breath

Mel Rosenberg came up with seven tips for good breath.

1. Clean the back of your tongue with a scraper or a toothbrush.
2. Eat breakfast. It gets the saliva flowing and cleans the tongue.
3. Chew gum or drink water to stop your mouth from drying out.
4. Rinse and gargle with a mouthwash just before going to sleep. This slows the growth of bacteria overnight.
5. Clean your mouth after you eat/drink smelly foods/drinks such as garlic, curry or coffee. If you eat or drink foods high in proteins, clean between your teeth.
6. Of course, always floss and brush.
7. The most reliable way to check for bad breath is to ask a family member to smell you.

fish-odour syndrome and others (1%)

There are a few dozen obscure causes that make up about 1% of cases of bad breath.

An interesting and rare cause is *Trimethylaminuria*. It's also called 'Fish-Odour Syndrome', and there are well over 200 cases

on record. Probably the first record of it is in the Indian *Mahabharata* (which in Sanskrit means 'Great Epic of the Bharata Dynasty'). The *Mahabharata* is one of the two major Sanskrit epics (the other is the *Ramayana*), which are great literary and religious works, and which deal with the evolution of Hinduism between 400 BC and 200 AD. The *Mahabharata* is huge — about seven times longer than the *Odyssey* and the *Iliad* combined. A small part of it tells the story of a young woman, Satyavata, who stank of 'rotting fish'. She was expelled from society because of her smell, but a demi-god took pity on Satyavata and bestowed a miracle cure on her.

But animals can get 'fish odour' too. A certain breed of Rhode Island Red chicken produces eggs which smell 'fishy', if the diet is rich in chemicals which lead to trimethylamine (formula $N(CH_3)_3$).

We all produce trimethylamine (which smells like bad fish) from the food we eat. Practically all of us make the enzyme that gets rid of trimethylamine. A very small number of people have low levels of this enzyme. So they have high levels of trimethylamine throughout their body. These molecules get picked up by the blood stream, travel into the lungs, jump into the airstream, and finally come out through the mouth — giving these poor unfortunates the persistent odour of rotting fish. The trimethylamine also comes out in the sweat and the urine (hence the name, trimethylaminuria). This condition can sometimes have a very severe impact on the sufferers, such as severe mental depression and rarely, attempted suicide.

cause of bad breath (3%)

In about 3% of cases, the tonsils cause bad breath.

The tonsils are part of your immune system. They have tiny little pits on the surface. Occasionally, bacteria live in these pits, and then get killed by your immune system. These conglomerations of dead bacteria and dead immune system cells

usually are squirted out of the little pits, and then swallowed into your stomach.

But sometimes, these dead bacteria don't get squirted out, they stay in the pits and calcify. They get turned into tonsilloliths (tonsil stones) that are about half the size of a head of a match, which can smell quite nasty. (You might see one if you sneeze into a tissue.) They cause no other medical problems, and so many doctors and dentists have not heard of them.

inside the nose (5%)

In 5–10% of cases, bad breath is made in the nose — from sinusitis, or a reduced mucus flow, or rarely, a foreign body.

There was the curious case of a 28-year-old woman who went to her doctor complaining of persistent bad breath. When he looked up her nose, he found a small bead that she put up there as a young child. When he removed the foreign body, the bad breath went away — after a quarter of a century.

The quality of the bad breath that originates in the nose is quite different from the bad breath that comes from the mouth, and this can be a diagnostic tool.

back of the tongue (85–90%)

In 85–90% of cases, bad breath is generated in the mouth — practically all on the back of your tongue. (A small percentage of mouth-generated bad breath comes from diseased teeth or gums. A famous encyclopaedia wrongly claims that *'Halitosis is due to the rotting debris in the pockets under the gum margins.'*)

The tongue is triply famous. First, it's the only muscle in your body that gets stronger with age. Second, it's probably the muscle that's the most fun to exercise. And third, the tongue is like a shag-pile

carpet. The bacteria responsible for bad breath live in the crypts (tiny holes) on the shag-pile surface of the tongue.

On average, you generate about 800–1500 ml of saliva each day. Saliva is good. First, it physically washes away nasty bacteria in your mouth, as well as the leftover food they like to eat. Second, saliva has various chemicals that help fight bacteria. And third, saliva contains various protein antibodies that kill some of the bacteria in your mouth.

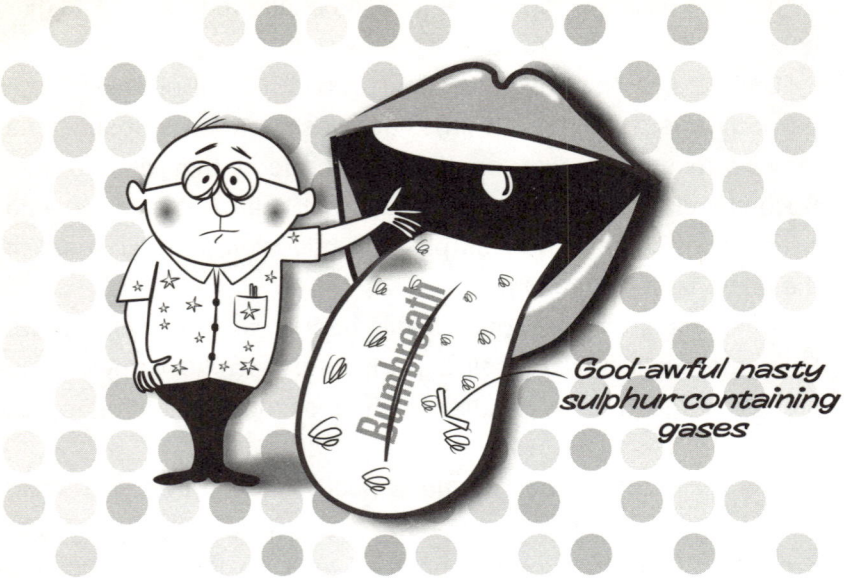
When you go to sleep, two things happen to your lovely saliva. First, the production of saliva plummets. Second, many people breathe through their mouth, which dries out what little saliva there is.

The very back of your tongue is poorly washed by saliva. Food collects there, and the bacteria love to eat it. So every night, the bacteria multiply like crazy, and they feed on leftover food and dead mouth cells. They also feed on postnasal drip, which happens to about one in four people.

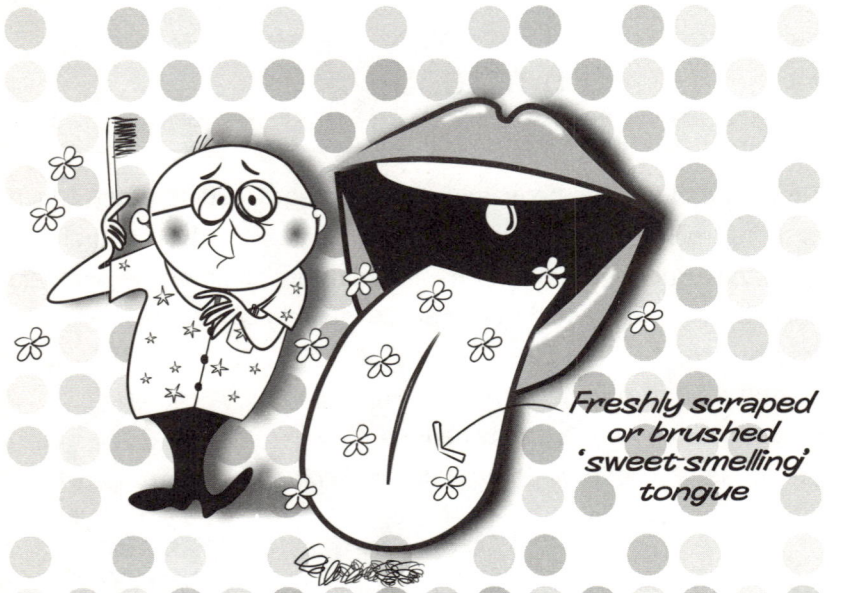
bumbreath

There is a difference between 'morning breath' (Bumbreath), which is at its worst when you wake up, and 'halitosis', which is there all the time. But they both have one thing in common — the bad odours seem to result from certain sulphur-containing gases in your breath.

In the Land of Science, everything has to be defined, and so Dr Levitt defines Morning Breath as *'malodorous breath upon wakening after a night's sleep'.*



Babe . . . you leave me breathless



bumbreath experiment

Levitt and his colleagues from the Minneapolis Veterans Affairs Medical Center and the Department of Medicine and the Department of Food Science and Nutrition at the University of Minnesota did a study with eight healthy adults aged between 27 and 51. 'Eight' is not really a large enough number to give you good statistics, but at least it's a start. The adults were all free of any dental disease, and none of them thought they had any halitosis.

The scientists collected gas samples from the mouth at various times during the day after waking up. These 'bad breath' gases almost qualify as Weapons of Mass Destruction. The scientists had to use polypropylene tubes and apparatus, because these 'bad-breath', sulphur-containing gases react with rubber and with glass! They also tried various treatments, in an effort to find what could reduce Morning Breath. They found three main sulphur-containing gases present in the samples of Morning Breath.

Hydrogen sulphide (H_2S), which smells like rotten eggs, had the highest concentration in Morning Breath. Its level was about 1.3 times greater than another sulphur-containing gas, methanethiol (CH_3SH), which smells like rotting cabbage.

And they also measured very small quantities of the gas, dimethylsulphide (CH_3SCH_3), which smells a little sweet. (Isn't that typical — the sweet-smelling gas is present in the lowest levels, about 16 times lower than the foul-smelling hydrogen sulphide. Scientists call this 'The Law of Maximum Inconvenience'.)

bumbreath removal

If the experimenters did nothing at all, the hydrogen sulphide in Bumbreath would decline significantly over the first hour after the

subjects awoke. Then it would increase over the next seven hours back to its original full-flavoured, stinky level.

Brushing your teeth with toothpaste for two minutes is good for the health of your teeth but it did nothing for Bumbreath. Swallowing a few herbal breath-freshening capsules also had no effect. Mechanical scrubbing of the tongue (by food or brushing) reduced the Bumbreath gases.

Eating food, like breakfast, reduced the concentration of hydrogen sulphide (rotten eggs) and methanethiol (rotten cabbage). In fact, a dry hard bread roll was quite effective in reducing the levels.

Brushing the tongue (not the teeth) with a toothbrush for one minute with water also reduced these nasty gases. The trick is that you really have to scrub the very back of your tongue. The problem is that you will probably involuntarily gag (this is a protective reflex, to stop you from swallowing insects and other unwanted intruders into your mouth). The solution is to hum while reaching right down to the back of the tongue (I discovered this by watching nature movies in various hotel rooms — at least, I think they were nature movies). On the other hand, cleaning the tongue has been practised in the East for thousands of years.

The most effective treatment of all was to gargle and rinse the mouth with 5 ml of 3% hydrogen peroxide for one minute. This significantly reduced the concentration of all three gases, and kept them low for the next eight hours.

So if you want to reduce Bumbreath when you wake up, hydrogen peroxide is best, but simply brushing your tongue comes a close second.

who has halitosis?

As I mentioned earlier, people who suffer most from halitosis are those whose job involves talking a lot — for example, politicians, lawyers, teachers and radio science broadcasters. Their mouths dry out as they talk, so the half a millilitre of saliva they generate

every minute gets absorbed by the dry mouth — and can't do its normal job of carrying away the bacteria.

Different nationalities around the world have different 'cures' for bad breath. Most Westerners believe mint can freshen your mouth. In Thailand, they chew the peels of oversized guavas, while Iraqis keep cloves between their teeth. Indians like to chew on fennel seeds, while Italians prefer parsley.

delusional halitosis

There's 'hunger breath' (bad breath from skipping meals), 'PMS breath' (the breath associated with a woman about to get her period) — and there's 'delusional halitosis', the bad breath you're having when you don't have bad breath.

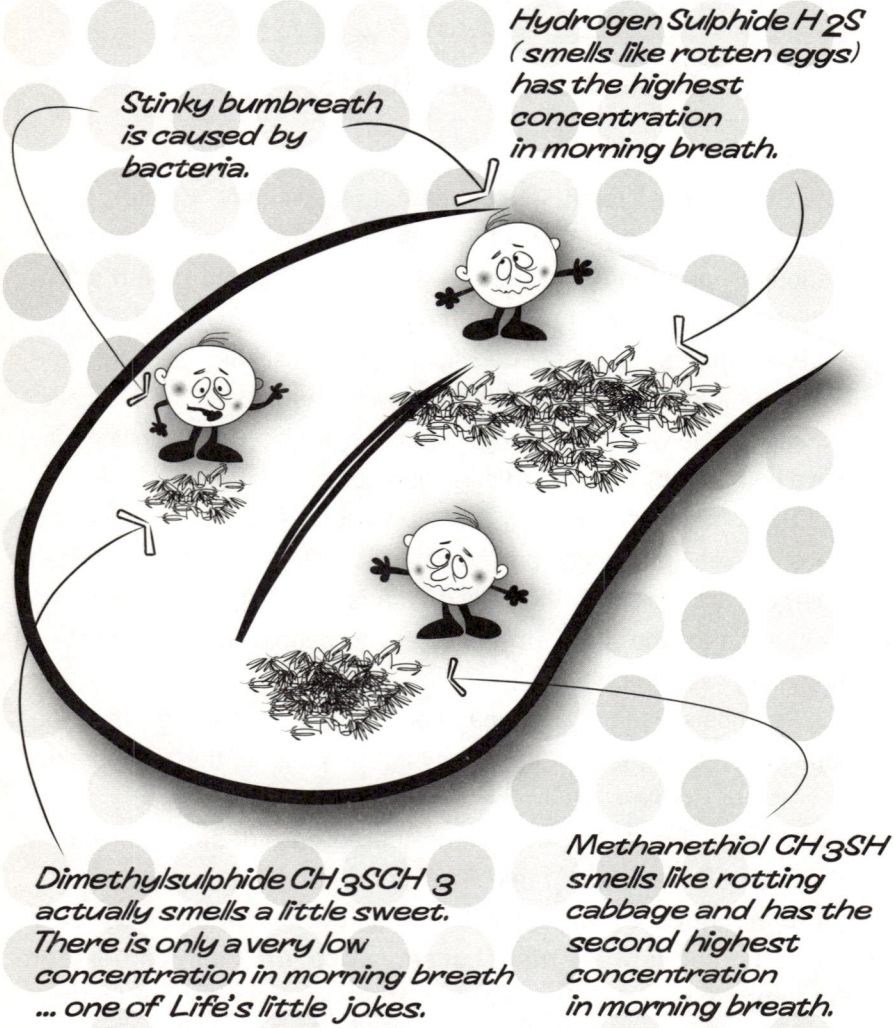
Psychiatrists classify delusional halitosis as one of the 'monosymptomatic hypochondriacal psychoses'. 'Mono-symptomatic' means people who have a single symptom (in this case, thinking they have bad breath) in their particular psychosis.

'Hypochondriacal' literally means 'under the chest'. People who have no real pathology, but continually suffer from poorly-defined pain, will often point to the belly (which is under or below the chest) as the site of the 'pain'. It now refers to people who have nothing physically wrong with them.

'Psychosis' means an impairment of your thinking, so that you lose contact with reality (the reality in this case, is that your breath is perfectly normal).

In 'delusional halitosis', the person is deeply convinced their breath is really rank. The condition can be serious — sufferers have been known to go to such extreme measures such as not leaving their house, giving up their careers or attempting suicide. One person tried so hard to purify their breath, they used 100 ml of toothpaste every four hours. Another student sufferer would get into their class extra early, sit all alone in a distant corner, and then use the fact that all

Bumbreath . . . who is responsible?


Hydrogen Sulphide H_2S (smells like rotten eggs) has the highest concentration in morning breath.
Stinky bumbreath is caused by bacteria.
Dimethylsulphide CH_3SCH_3 actually smells a little sweet. There is only a very low concentration in morning breath ... one of Life's little jokes.
Methanethiol CH_3SH smells like rotting cabbage and has the second highest concentration in morning breath.

the other students sat closer to the front as proof that they had really bad breath.

One study looked at 32 people who all suffered delusional halitosis — and not one of them had any hint of bad breath.

Other 'monosymptomatic hypochondriacal psychoses' include the delusion you have small seed-like objects under the skin, the delusion your skin is infested by parasites, and the delusion your dental bite is abnormal (Phantom Bite Syndrome).

Halitosis and Snoring in a Dog

The owner of a 14-year-old crossbred dog brought his beloved pet, which had very bad breath and noisy breathing, to the Veterinary Clinic at the University of Sydney. The dog had vomited after eating a large meal of raw chicken, and then had developed very bad breath, a cough and a 'snoring' noise when it breathed.

The vets took x-rays of the head (where the noise was coming from) and the chest (because of the history of coughing). They saw 'a cylindrical radio-opaque foreign body' — what you and I would call a chicken bone.

The vet thought when the dog vomited up the chicken bones from its meal, one of them had impacted hard at the back of the nose and stayed there.

The immune system attacked this foreign body. This caused a local inflammation, which led to an accumulation of mucous and exudates, an awful lot of 'associated putrefaction' and a really foul odour.

The wedged chicken bone caused abnormal dripping of a nasty-smelling liquid (postnasal drip). When this dripped into the dog's airways, it made the dog cough.

The chicken bone was in the path of the air when the dog breathed in through its nose. The bone produced turbulent airflow, and this caused the snoring. That's how the bone caused the smell, the cough and the snore.

The treatment was easy. They anaesthetised the dog and *'with some difficulty it was possible to dislodge the bone by a gentle side-to-side rocking action and to remove it through the mouth'*. They recovered *'a chicken bone covered by foul-smelling tissue debris'*.

The vets at the hospital had previously found other foreign bodies at the back of the nose — not just bones, but tablets and even blades of grass. Again, they had most probably been rammed into position by very forceful vomiting.

smell own breath

How can you tell if your breath stinks? Think of the advantages if one could smell one's own bad breath. You could avoid the massive embarrassment of trying to discover from a friend if your own breath ponged, or of finding a delicate way to tell a friend that their breath reeked.

Luckily, in 1995, Mel Rosenberg looked at (and solved) this problem when he ran an 'Oral Malodor Clinic' in Tel-Aviv. He set up a study to see if people were '*able to smell their own malodor*'. Mel worked with 52 Israeli citizens, 43 of whom claimed that they had bad breath.

He had them run through some 'well-tried-and-possibly-true' techniques for inhaling and checking your own bad breath. He got

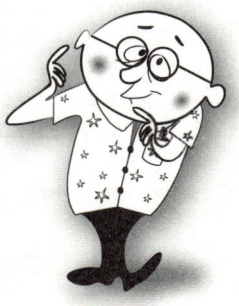
them to cup their hands over their mouth and nose, and then breathe out through the mouth and in through the nose. He also got them to do the 'breathe–rebreathe' thing under the blankets, as well as smelling their freshly-used telephone mouth piece and their freshly-used piece of dental floss. He even got them licking their wrist '*in a perpendicular fashion*', and then sniffing it.

He then experimented with his own brand new technique. They were to spit into a laboratory dish that was then closed and cooked at 37°C for five minutes, and finally 'presented for odour assessment' to the spitter.

Of course, Dr Rosenberg would be the impartial 'odour judge'. This meant he had to sniff 52 mouths breathing upon him, 52 saliva-covered wrists, 52 telephone mouth pieces, 52 strands of dental floss, and 52 warmed-up samples of saliva in a laboratory dish. To make sure his nose didn't get overloaded and stop functioning normally, he would regularly sniff his control solution — '*a chicken-dung based fertiliser in aqueous suspension ... in an opaque sniff bottle*'.

The results were clear — there is no simple way to check if you have bad breath. There was absolutely no relationship between how the volunteers, and Rosenberg, rated people's breath odour.

The only test with any reliability was the 'incubated spit technique'. It's not simple, but you can monitor your own breath status — though you have to go to the trouble of carrying around a sealable laboratory dish, and 'cooking it' under your armpit or next to your body for five minutes. Or ask a friend.



Listerine: The Name

Listerine was named after Sir James Lister. Back in the 1860s, the only people who knew about bacteria were a few scientists with microscopes. Most doctors, if they had ever heard of them, thought bacteria had nothing to do with disease. James Lister campaigned against the lack of hygiene practised by most surgeons. Back then, surgeons didn't wash their hands, didn't sterilise bandages, and allowed spectators to crowd in close to the operating table. The death rate after surgery was as high as 90% — mostly because of infection. Eventually, the surgeons took up Lister's call for 'antiseptic surgery'. In St Louis, Dr Joseph Lawrence was so impressed that in 1880, he named his new anti-bacterial liquid after Lister — as Listerine.

References

Rosenberg, M., 'Bad breath: diagnosis and treament', *University of Toronto Dental Journal,* vol. 3, 1990, pp. 7–11.

Guyton, Arthur C. & Hall, John, *Text Book of Medical Physiology,* W.B. Saunders Company, 1996, pp. 815–819.

Laurendet, H., Govendir, M., Porges, W.L. & Malik, R., 'Snoring and halitosis in a dog', *Australian Vet. Journal,* vol. 76, no. 4, April 1998, pp. 245, 250–251.

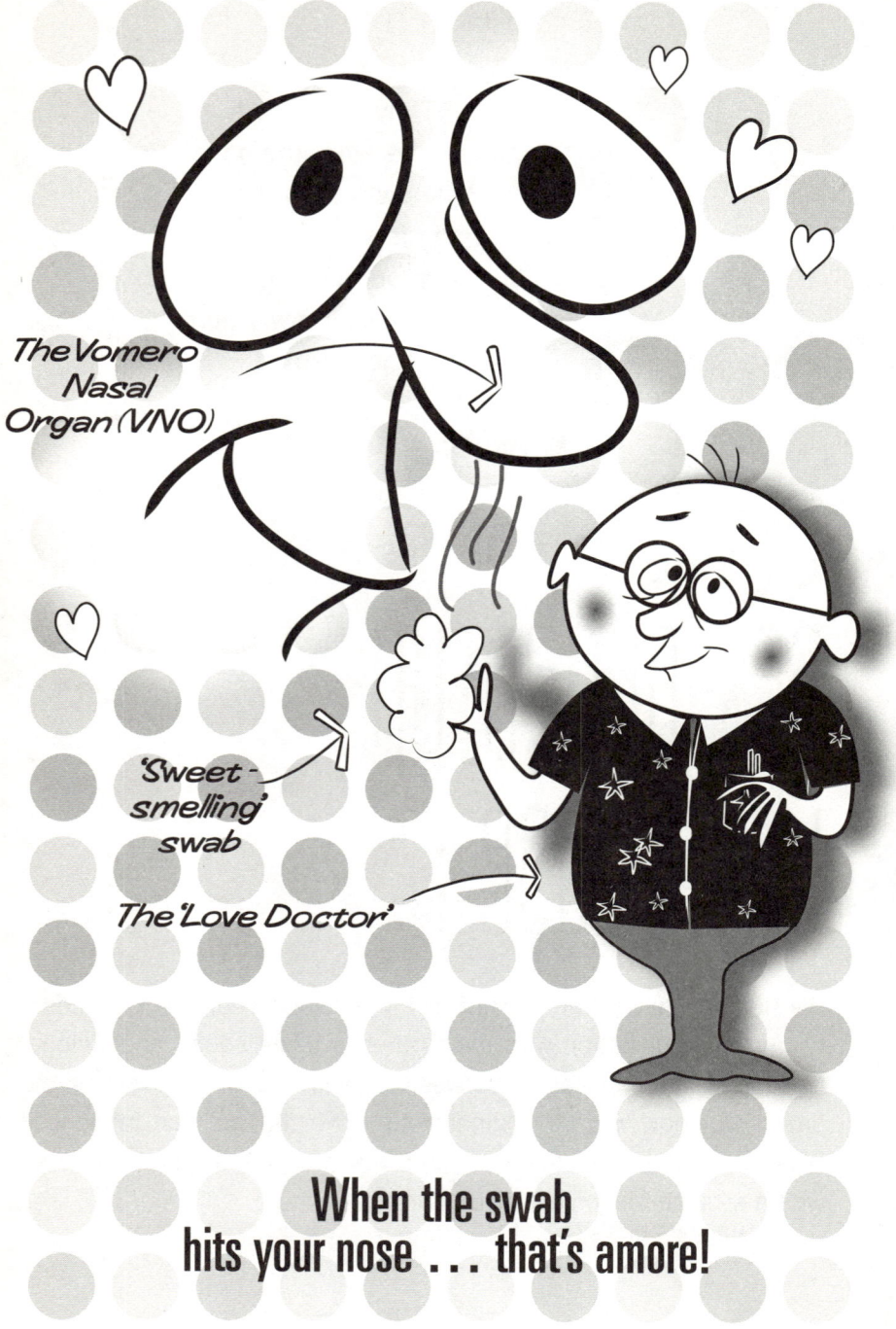
Levitt, M.D., *et al.*, 'Morning breath odor: influence of treatments on sulfur gases', *Journal of Dental Research,* vol. 79, no. 10, July 2000, pp. 1773–1777.

'The science of bad breath', *Scientific American*, April 2002, pp. 58–65.

They say nobody knows what the nose knows — but now scientists have begun to work out just what the nose does know. And it knows sex ...

sex organ up your nose

We humans have a number of highly-developed senses, but most of our communication with each other involves sound and vision. Not much communication between people involves the sense of smell. But now we are beginning to prove that we can influence each other with our smells — and, that we pick up these smells with a strange sex organ inside our noses!



When the swab hits your nose . . . that's amore!

a sense of smell

Scientists who study human anatomy have known for a long time about the 'olfactory epithelium'. 'Olfactory' means 'related to smell'. The olfactory epithelium is a patch of yellowish tissue high up in the 'ceiling' of the nose. Normally it is poorly ventilated, but when we sniff deeply, we pass lots of air over it. In this yellow patch, there are sensory cells specially adapted for smelling. Chemicals in the air enter the nose, excite the sensory cells, and then we get the sensation of 'smell'.

vomeronasal organ

There is also another area in the human nose that can be used to detect odours — but until recently, most scientists didn't believe it existed! This is the VNO, which stands for 'vomeronasal organ'. Fishes, birds and some mammals don't have a VNO, but it is very well developed in snakes and lizards.

It was first discovered by the Dutch anatomist, Ruysch, in 1703. It's about a centimetre inside the nose located right next to the wall that separates the nostrils, on the 'floor' of the nose. There's one in each nostril. It looks like a hollow tube, with only a very small opening (about one-tenth of a millimetre across) into the nose. Each VNO is very small and difficult to see. This might be why the vomeronasal organ fell out of favour, and soon anatomists didn't even believe it existed. By the 1930s, physiologists maintained that not only did we humans definitely not have a VNO, but there was no structure in the brain to process the information from any such organ. However, in 1991, a careful study revealed that 910 out of 1,000 people had an easily-found VNO. But the fact that we have one does not mean that it does anything.

Pheromones

Some scientists have long thought that the VNO might be involved in 'pheromones'. This was a word invented in 1959 by Doctors Karlson and Lusche. 'Phero' means 'to carry', and 'hormone' means 'to excite' — so 'pheromone' means hormones that travel through the air, from one creature to another. We humans are not usually consciously aware when we are 'smelling' pheromones.

Pheromones control mating preferences in hamsters, dominance relationships in male elephants, the timing of puberty, and they can even prevent implantation of fertilised eggs. Back in 1971, Martha McClintock showed that women living together tended to synchronise menstrual cycles — and that pheromones were almost certainly involved.

smells electrified

In 1994, Luis Monti-Bloch and his team from the University of Utah actually managed to thread very fine insulated electrical wires into the VNOs of volunteers. The researchers then wafted various smells up the noses of their volunteers, and looked for electrical activity in the cells of the VNO. These smells were various odourless chemicals from the skin of men and women. The volunteers had absolutely no conscious idea that they were responding to these smells — in other words, their olfactory

epithelium, which smells perfumes and pollutants, did not trigger. The cells in the males' VNOs fired when they got female skin smells, and female VNOs responded to male skin smells. But the VNOs did not respond to skin smells from the same sex.

It was odd that the volunteers didn't consciously realise that their VNOs were being stimulated. We could waft a smell up their noses, and their VNOs could fire frantically with electrical activity — but all the volunteer experienced was a vague, generalised emotion of feeling fine.

smelly armpits

But in early 1998, an excellent experiment showed a more definite effect — that some female smells could trigger women's menstrual cycles. Kathleen Stern and Martha McClintock from the Psychology Department at the University of Chicago asked some 'donor' women to donate the smells in their armpits (via a pad that they wore for eight hours a day). They then exposed some 'recipient' women to these smells — which were completely odourless, as far the recipients' conscious brains were concerned. And of course, the two groups, donors and recipients, never met face to face.

The smells were taken from the donor women at two different times in their menstrual cycle. When the smells were taken before the donors ovulated, the recipients' menstrual cycles became shorter. But when the smells were taken right at the time of the donors' ovulation, the recipients' menstrual cycles became longer. The overall effect was to synchronise the cycle of the recipient with the cycle of the donor.

This was a pretty good experiment, but we're still not totally sure that the smells from one human can influence another human. For one thing, this effect happened in only 70% of the volunteers — so what's going on in the brains of the remaining 30%? In addition, our neuroanatomists have not yet proved that nerves from the human VNO travel to the relevant parts of the

brain. With our current technology, the only way to do that is to get several corpses, add some dye to the VNO, wait a few months for the dye to migrate, and then very carefully cut open the brain and analyse it.

So if your boyfriend or girlfriend gets up your nose, it may not be their fault.

References

'Signals from pheromones go directly to the midbrain', *Australian Science Teachers Association*, vol. 47, no. 4, November 2001, p. 27.

Leinders-Zufall, Trese, *et al.*, 'Ultrasensitive pheromone detection by mammalian vomeronasal neurons', *Nature*, vol. 405, 15 June 2000, pp. 792–796.

Monti-Bloch, L., Jennings-White, C. & Dolberg, D.S., 'The Human Vomeronasal System', *Psychoneuroendocrinology*, vol. 19, nos. 5–7, 1994, pp. 673–686.

Monti-Bloch, Luis, *et al.*, 'The functionality of the Human Vomeronasal Organ (VNO): evidence for steroid receptors, *Journal of Steroid Biochemical Molecular Biology*, vol. 58, no. 3, 1996, pp. 259–265.

Motluk, Alison, 'Go for it, baby — being around women who breastfeed has an unexpected effect', *New Scientist*, no. 2340, 27 April 2002, p. 11.

Weller, Aron, 'Communication through body odour', *Nature*, vol. 392, 12 March 1998, pp. 126–127.